Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 3334-3341

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-11 pp. 3334-3341**
Journal homepage: http://www.ijcmas.com

Original Research Article

To Study the Preparation of Crop Weather Calendar of Soybean Crop under Parbhani Location

V.S. Misal, S. S. Deshmukh* and A.M. Khobragade

Department of Agricultural Meteorology, College of Agriculture Parbhani, Maharashtra, India

**Corresponding author*

Keywords

Soybean, Crop weather calendar, Rainfall, Temperature etc.

A B S T R A C T

An investigation was carried out during 2018-2019 at Department of Agricultural Meteorology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, as "Preparation of crop weather calendar of soybean crop under Parbhani Location" with an objective to study the preparation of crop weather calendar of soybean crop under Parbhani Location, to study the phenological stages of soybean crop for crop weather calendar and to prepare the crop – weather – pest calendar for soybean crop using pest data. In study of climatic condition during 1988-2017 (30 years data) showed variability in climatic condition at Parbhani location of Marathwada region. Temperature variability at Parbhani location results into change in the yield of soybean crop in Marathwada region. The range of highest mean maximum temperature and lowest minimum temperature recorded 33.70C and 24.3^{0}C while highest and lowest mean rainfall was recorded i.e. 785 mm since 1988-2017.

Introduction

Soybean (Glycine max (L.) Merrill) is a leguminous crop and belongs to family leguminosae. Soybean is also known as „wonder crop" and „gold of century" due to easy cultivation, high cost benefit ratio and low nitrogen requirement. Soybean is a native of Asia and the first known records, however, indicate that soybean emerged as a domesticated crop around the eleventh century BC in China. Soybean was introduced in India in 1970-80. It is an important pulse crop rich in food value. It is a cheapest, richest and easiest source of best quality protein and fat. Soybean was considered as pulse crop but due to high oil content and greater response to applied nitrogen, now it is placed in oil category.

Soybean, being leguminous crop, improves soil fertility by fixing atmospheric nitrogen (AICRP on Agrometeorology, Parbhani Centre).

The pictorial representation of detailed information for a crop w.r.t. sowing period and duration of important phenological stages in their life cycle, the most favourable climatic requirement for different stages of the crop and the actualand normal weather for that station/location is called the "Crop Weather Calendar" (Kaur *et al.*, 2013).

Agriculture is one of the most important sectors for India. Proper planning for this sector requires relevant and reliable information in timely manner. Information on crop, its stages and the week by week weather during the crop season is essential

for proper management of agriculture. Thus, farm operations planned in conjunction with weather information are very likely to curtail the costs of inputs and various field operations. Crop weather calendar is a comprehensive guide for farmers. It is a tool that provides information on average weather of every week, planting, sowing and harvesting periods of locally adapted crops in a specific agro-ecological zone. Further, stage-wise pest disease infestation information can also be added. It also provides information on the sowing rates of seed and planting material and the main agricultural practices. This tool supports farmers and agriculture extentionists in taking appropriate decisions on crops and their sowing period, respecting the agro-ecological dimension. It also provides a solid base for emergency/ contingency planning of the rehabilitation of farming systems after disasters. The concept of using crop-weather calendar is not new. For instance, FAO calendars provide information on the crop sowing and harvesting dates, seed rate, operation timings of mechanical equipment in the period etc. Also, the University of Kentucky prepared production calendars for soybean and maize crops. This calendar describes the month wise weather and operations to be taken up during the period (CRIDA 2015).

Materials and Methods

The present research work on "Preparation of crop weather calendar of soybean crop under parbhani location" was conducted in the Department of Agricultural Meteorology, VNMKV, Parbhani.

The climatic conditions are the indispensible topic in rainfed as well as irrigated farming system; the agricultural researches are planned according to the expected change in weather condition regionally. Without understanding the characterization and behavior of the changing weather parameters in coming days, how we will plan the research work and prepare crop weather calendar of soybean crop. Several studies on effect of increased temperature levels and incidence of pests on crop production endorse that there would be drastic reductions in crop yields. In agricultural production weather parameters play an important role. Soil and climate are two important resources which help in crop planning. For this purpose, the study of characteristics of temperature, rainfall, relative humidity, bright sunshine hours, wind speed and evaporation and its impact on crop phenology and incidence of pests is very important.

The methodologies and data that were used are described in this chapter under appropriate heads.

Structure of crop weather calendar

Structure of crop weather calendar designed by AICRPAM consist of three part in the main body as depicted in figure climatic normals for location specific crop growing season is presented in the upper portion phenological event of the crop are represented in a weekly time frame. In the middle portion together with favorable climatic parameter to realize potential or optimum yield. On the lower parts of the calendar the favorable weather conditions for development of pest are reported. The components of each part of the calendar are discussed here under.

Crop weather calendars

Weather is one of the most important factors affecting the agricultural production. The increase in climatic variability and associated extreme weather episodes such as erratic rainfall distribution, abrupt change in day and

night temperatures during crop season and sudden outbreaks in pest disease population, especially in developing countries are throwing challenges to sustaining production levels of different crops. One strategy that farmers can adopt to sustain or increase crop yields in the face of a highly variable climate is to manipulate the crop environment through improved management strategies for adaptation.

Agriculture is one of the most important sectors for India. Proper planning for this sector requires relevant and reliable information in timely manner. Information on crop, its stages and the week by week weather during the crop season is essential for proper management of agriculture. Thus, farm operations planned in conjunction with weather information are very likely to curtail the costs of inputs and various field operations.

The concept of using crop-weather calendar is not new. For instance, FAO calendars provide information on the crop sowing and harvesting dates, seed rate, operation timings of mechanical equipment in the period etc. Also, the University of Kentucky prepared production calendars for soybean and maize 78 crops. This calendar describes the month wise weather and operations to be taken up during the period.

Results and Discussions

To study the preparation of crop weather calendar of soybean crop under Parbhani Location Weather data was grouped under different years of soybean crop, so as to know the crop behavior to weather during different years of crop in Parbhani location weather data prevailed during 1988-2017 (23MW to 43 MW) and soybean crop data. The relevant data were presented in table 1 and graphical form.

Crop weather calendar of soybean crop

Weather is one of the most important factors affecting the agricultural production. The increase in climatic variability and associated extreme weather episodes such as erratic rainfall distribution, abrupt change in day and night temperatures during crop season and sudden outbreaks in pest disease population, especially in developing countries, are throwing challenges to sustaining production levels of different crops. One strategy that farmers can adopt to sustain or increase crop yields in the face of a highly variable climate is to manipulate the crop environment through improved management strategies for adaptation.

Agriculture is one of the most important sectors for India. Proper planning for this sector requires relevant and reliable information in timely manner. Information on crop, its stages and the week by week weather during the crop season is essential for proper management of agriculture. Thus, farm operations planned in conjunction with weather information are very likely to curtail the costs of inputs and various field operations. Crop weather calendar is a comprehensive guide for farmers. It is a tool that provides information on average weather of every week, planting, sowing and harvesting periods of locally adapted crops in a specific agro-ecological zone. Further, stage-wise pest disease infestation information can also be added.

It also provides information on the sowing rates of seed and planting material and the main agricultural practices. This tool supports farmers and agriculture extentionic workers in taking appropriate decisions on crops and their sowing period, respecting the agro-ecological dimension. It also provides a solid base for emergency/ contingency planning of the rehabilitation of farming systems after disasters.

Table.1 Yearly average weather data recorded different meteorological week during 1988-2017 (23MW-43MW) soybean crop at Parbhani location

Average weather data								
Year	**T.Max (^{0}C)**	**T.Min (^{0}C)**	**RH-I (%)**	**RH-II (%)**	**RF (mm)**	**Bright Sunshine (hrs)**	**Evaporation (mm)**	**Wind Speed (Km hr^{-1})**
1988	33.2	20.5	68	52	1553.3	6.0	5.0	8.6
1989	32.6	21.1	62	42	1269	6.2	5.9	**9.7**
1990	29.2	19.9	62	53	**1556.2**	5.4	5.1	9.4
1991	32.5	18.0	56	33	700.7	6.3	5.7	8.7
1992	32.5	21.4	65	36	684.7	7.3	6.2	7.6
1993	31.3	20.2	**18**	**11**	713	6.8	6.0	7.8
1994	28.7	21.2	66	44	654.1	5.3	5.2	7.6
1995	31.5	22.3	65	47	621.4	6.9	6.0	7.0
1996	28.5	21.7	67	49	746.9	6.8	5.9	6.7
1997	33.0	21.2	82	28	513.4	**7.5**	5.4	6.8
1998	**24.3**	15.7	73	26	1161	5.8	**4.0**	**3.7**
1999	29.2	12.0	66	27	782	5.8	4.4	6.5
2000	32.2	**11.7**	58	41	657.8	6.7	4.8	5.6
2001	30.7	21.4	68	50	550.3	5.7	4.5	6.2
2002	29.8	21.2	62	44	706.1	6.5	5.4	6.2
2003	30.0	21.4	63	46	630	6.7	5.3	5.7
2004	30.3	21.2	61	44	446.2	6.7	5.7	6.0
2005	29.7	21.8	60	46	1030.5	6.1	4.8	5.5
2006	29.4	21.6	66	50	837.2	6.3	4.9	5.6
2007	28.9	21.9	69	45	700.1	6.9	4.5	5.1
2008	30.4	21.9	70	57	550.2	5.5	5.1	5.3
2009	33.3	21.3	62	50	552.5	6.4	5.7	5.9
2010	31.4	22.0	65	**64**	928.7	5.6	4.5	5.0
2011	31.9	**23.6**	85	55	624.5	6.1	5.2	5.5
2012	32.2	22.3	84	54	558.7	5.6	5.2	5.0
2013	30.5	22.5	**88**	63	863	**4.4**	4.3	4.8
2014	33.6	22.0	80	50	414.7	5.6	4.5	5.3
2015	**33.7**	22.8	78	48	**408.1**	6.5	**6.8**	5.9
2016	31.7	22.1	85	60	1126.7	5.3	5.1	5
2017	32.2	22.5	84	60	995.7	5.7	4.9	4.4
Mean	**30.94**	**20.6**	**68**	**45**	**785**	**6.1**	**5.2**	**6.2**

CROP WEATHER CALENDAR

CROP NAME : SOYBEAN **DURATION: SHORT(95-120 days)** **STATE : MAHARASHTRA** **DISTRICT : PARBHANI**

Climatic Normals

MONTH	JUNE				JULY				AUG					SEPT				OCT			
MW / Parameter	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Rain (mm)	58.5	71.2	59.9	109.6	101	126.4	97.9	216.3	106.8	80.2	56	133.9	100.7	98.5	88	121.3	37	58.7	47.7	25.4	2.8
Tmax(°C)	38	36.2	34.9	33.6	33.3	32.4	31.9	30.5	30.6	30.3	31.1	30.7	30.8	30.9	31.4	31.3	32.4	32.7	33.2	33.2	32.5
Tmin (°C)	24	24	23.6	23.1	22.9	23.5	22.9	22.3	22	21.9	21.9	21.6	23.6	21.7	21.7	21.4	21	20.5	19.6	17.9	15.7
RH-I (%)	71	74	76	80	81	82	82	81	83	84	83	84	83	83	86	85	80	79	79	74	72
RH-II (%)	34	45	49	54	55	78	62	64	67	65	62	65	65	65	64	65	55	50	47	40	38

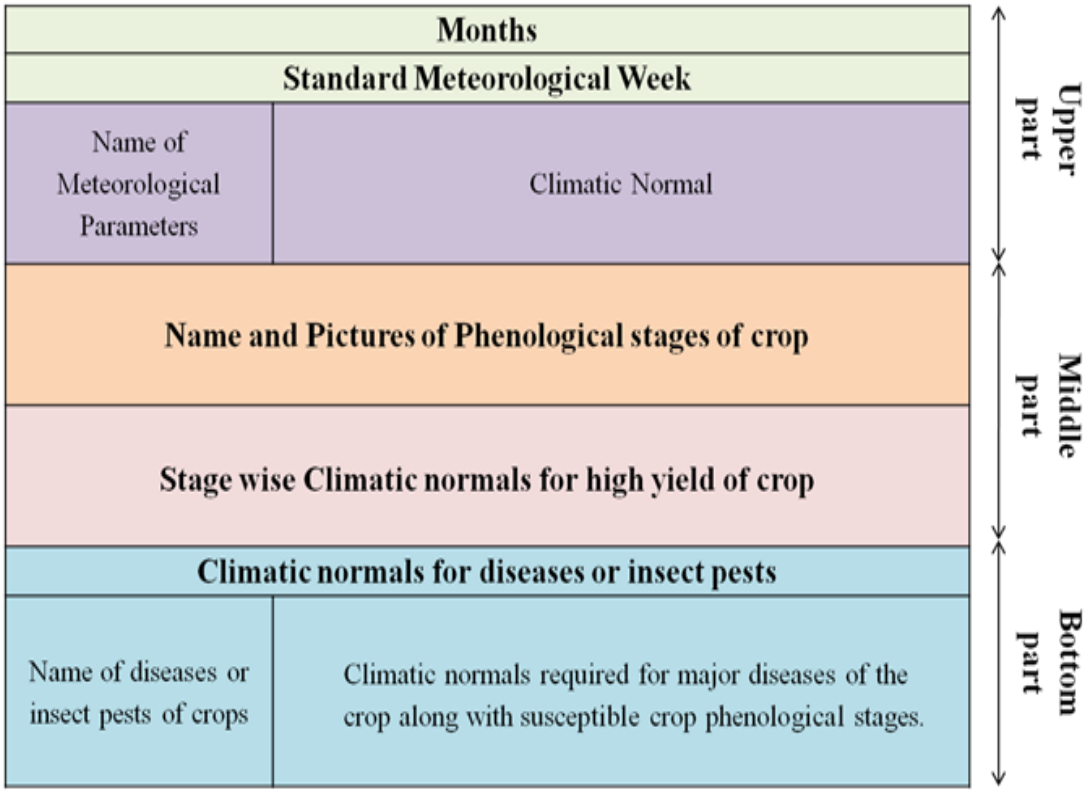
Phenophases	Emergence	Seedling	Branching	Flowering	Pod formation	Grain formation	Pod development	Pod containing full size grain	Dough stage	Maturity
Duration (Days)	4-6	21-29	4-9	4-6	4-9	4-9	4-10	8-10	10-15	8-14
Phenophase wise weather for better yield										
Tmax(°C)	28.1-34.7	28.1-32.4	28.31.7	27.5-33.3	30-31.7	30.7-35.5	29.5-34.6	28-32.5	33.7-34	32.5-33
Tmin (°C)	19.5-23.6	18.7-24	22.5-24	20-22.5	19-23.5	20.5-23	19.5-22.5	17-22	18.5-22.5	16-20.5
RHm (%)	80-87	81-88	79-88	85-89	86-88	89-92	84-88	75-84	76-82	75-80
RHe (%)	56-70	54-65	66-65	54-60	62-66	65-70	62-68	47-62	45-60	32-45
BSS (hrs)	4.2-4.6	3.4-4.5	4-5	4.5-6	3.5-4.8	4.5-5	4.2-4.6	5-8.5	4.5-9	5-10
Rain(mm)	40-90	115-290	45-90	50-115	115-260	55-60	75-130	40-100	35-55	20-30

Favourable Weather Forpest incidence

Girdle beetle	Tmax:29.4-33.4°C,Tmin 19.7-25.7°C,RH-I 79-90%,RH-II49-70%
Semilooper	Tmax:29.4-33.2°C,Tmin 19.6-27.8°C,RH-I 69-97%, RH-II 48-70%
Leaf miner	Tmax:29-33.2°C,Tmin 19.6-25.5°C,RH-I 69-90%,RH-II48-70%
Spodopteralitura	Tmax:29.5-33.2°C,Tmin19.3-26.8°C,RH-I 80-89%,RH-II56-70%

Fig 4.1: Crop Weather Calendar of Soybean crop under Parbhani Location during 2002-2017

Structure of crop weather calendar



The concept of using crop-weather calendar is not new. For instance, FAO calendars provide information on the crop sowing and harvesting dates, seed rate, operation timings of mechanical equipment in the period etc. Also, the University of Kentucky prepared production calendars for soybean and maize crops. This calendar describes the month wise weather and operations to be taken up during the period.

Crop weather calendar divided in three part, Upper part, Middle part and Bottom part are pictorial represented in fig. 1.

Upper part (Climatic normals)

These climatic normals of this centre were computed for total weekly rainfall (mm), weekly maximum temperature (^{0}C), minimum temperature (^{0}C), maximum relative humidity (%), minimum relative humidity (%), arranged in standard meteorological week wise in the upper portion of crop weather calendar. An arrange climatic normal for soybean crop at Parbhani centre are depicted in fig. 1. The highest total rainfall recorded in 30th MW (216.3mm) whereas, the mean highest Tmax (38^0C) and Tmin (24^0C) recorded in 23rd MW. Maximum RH-I and RH-II recorded in 37thMW and 28thMW (86%) and (78%) respectively and minimum RH-I (71%) and RH-II (34%) recorded in 23rd MW.

Middle part (Phenological observation)

Phenological stages of soybean crop arranged in such way that sowing to at harvesting stage of soybean crop are depicted in fig. 1. The more days required for emergence to seedling stage of soybean crop i.e. (21-29 days). The highest range of mean T max and T min found 30.7^0C -

35.5^0C and 22.5^0C – 24.0^0C pod formation to grain formation stage and seedling to branching respectively. Mean maximum RH-I and RH-II observed in pod formation to grain formation stage. BSS maximum record at dough stage to maturity. The maximum rainfall record in seedling to branching stage of soybean crop is depicated as fig. 1.

Bottom part

The part of the crop weather calendar which contain the climatic normals required for major pest and disease of soybean crop as well as susceptible crop phenological stages of soybean crop. The more major pest i.e. green semilooper, leaf miner, spodopteralitura and girdle beetle were observed during branching to flowering, flowering to pod formation and pod formation to grain formation due to insufficient rainfall and aberrant weather condition.

In conclusion, the highest and lowest mean maximum and minimum temperature recorded i.e. 30.9vC and 20.6^0C respectively. Among the mean highest and lowest RHI recorded 88% and 18% during the period of 1988-2017. The average of RH-I throughout the year was 68% due to aberrant weather condition. While afternoon highest and lowest RH II was recorded 64% and 11% between the years 1988-2017 and total average of RH II during the years were 45% due to most of the cloudy weather situation. After the most favorable factors, rainfall affected the cropping pattern during the crop growing environment. The total rainfall was recorded highest at Parbhani location (i.e. 1556 mm). The range of mean bright sunshine hours was observed at Parbhani location (i.e. 4.4 -7.5 hrs). In case of evaporation, the highest and lowest mean observed i.e. 6.8 mm in 2015 and 4.0 mm in the year 1998 throughout the year. The mean evaporation recorded 5.2 mm respectively. In respect of wind speed highest and lowest mean wind speed observed was i.e. 9.7 $kmhr^{-1}$ in the year 1989 and i.e. 3.7 kmhr-1 during 1998.

In the case of soybean crop the maximum GDD, HTU and PTU requirement was (2332.2^0C days), (14231.3^0C days hour) and (i.e. 24234.6^0C days hour) found in the year 2003-2017 respectively.

In crop growing period the highest total Rainfall was observed at Parbhani i.e. 1556.2 mm and lowest i.e.408.1 mm, highest and lowest mean T max 33.7^0C and 24.3^0C and T min recorded 23.6vC and 11.7^0C, highest and lowest mean RH-I 88% and 18%, highest and lowest mean RH-II 64% and 11% and mean BSS 7.5 hrs and 4.4 hrs respectively in the year 1988-2017.

References

Chavan K.K, Khobragade A.M, Kadam.Y.E. and Mane R.B (2018) Study the heat unit requirement of soybean (Glycine max) varieties under varied weather condition at Parbhani. Journal of Pharmacognosy and Phytochemistry pp: 526-530.

Chavan K.K., Khobragade A.M., Mane R.B. and Dendage V.R. (2017) Performance of Soybean Varieties under Varied Weather Condition. International Seminar on Global Climate Change: Implications for Agriculture and Water Sectors (CCAW2017).

Chapman, J. (1986) the influence of photoperiod and temperature on the pre- flowering phase length of eleven soybean cultivars in northern natal. S. Afr. J. Plantso., 3 (2):61-65.

Jha A., Ranjan R., Meena R.P., Sharma R.K. and Chhokar R.S. (2018) Crop Weather Calendar : A Guide to the Farming Community. Resource Management Division, ICAR- IIWBR, Karnal.

Kulkarni, S. S. (2012) Impact of weather parameters on pests of soybean, M.Sc. (Agri) Thesis submitted to V.N.M.K.V. Parbhani (MS), India.

Kaur P., Bala A., Singh H. and Sandhu S.S. (2013) Guidelines to prepare crop weather calendar. All India Coordinated Research Project on Agrometeorology. School of climate change and Agricultural meteorology. Punjab Agricultural University, Ludhiana. 18p.

Khobragade A.M (2015) Crop weather calendar of Cotton – Parbhani. District level crop weather calendars of major crops in India. Central Research Institute for Dryland Agriculture, 2015.

Karunakar A. (2015) Crop weather calendar of Soybean – Akola. District level crop weather calendars of major crops in India. Central Research Institute for Dryland Agriculture, 2015.

Khobragade A. M., Jadhav M.B., P. Vijaya Kumar and Rao V.U.M. (2016) Agro Advisory Bulletin (AAB) in relation to prevailing weather condition at village level under AICRPAM-NICRA project for Marathwada region.

Khobragade A.M , Asewar B. V., Dakhore K. K., Gote G. N, P. Vijayakumar and V. Rao U. M. (2016) Agrometeorology of soybean crop in Marathwada region of Maharashtra state of India. Technical bulletin-AICRP on Agrometeorology V.N.M.K.V. Parbhani pp: 10-22.

Rao V.U.M., SubbaRao, Sarath Chandran, KaurP.,P.Vijaya Kumar, Rao B. B., Khandgonda I.R and Ch. SinivasaRao (2015) District Level Crop Weather Calendars of Major Crops in India CRIDA [2015]-Central Research institute on Dryland Agriculture.

Sionit N., Strain B.R, and Flint E.P. (1986). Interaction of temperature and CO2 enrichment on soybean: Growth and dry matter partitioning. Can. J. Plant Sci.67 : 59-67.